



SCG VERSUS COSTOCHONDRAL GRAFT IN RECONSTRUCTION OF ANKYLOSED TMJ :- A COMPARITIVE STUDY

Dental Science

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ABSTRACT

Introduction The temporo-mandibular joint (TMJ) is a complex anatomical structure that is concerned with mastication, deglutition, and speech. Ankylosis of the TMJ occurs when the condyle gets fused to glenoid fossa by bony or fibrous tissue. It is an incapacitating problem, commonly occurring in children and is usually associated with trauma or infection.

Materials And Methods A total of ten patients with written informed consent having TMJ ankylosis (unilateral/bilateral) fulfilling the inclusion criteria were selected for the study and were operated under general anaesthesia with arthrectomy followed by reconstruction of ramal condylar unit with SCG (Group I) or CCG (Group II). Pre-operative and post-operative evaluation assessments were done at regular intervals for maximum mouth opening, range of mandibular movements, and height of ramus. **Results** Statistical analysis shows that the increase in maximum mouth opening was found 1.1% higher in Group II (75.9%) as compared to Group I (74.9%). The increase in lateral excursion at affected side was found 1.3% higher in Group I (84.6%) as compared to Group II (83.3%). The increase in lateral excursion at non-affected side was found 10.3% higher in Group I (76.9%) as compared to Group II (66.7%). The increase in protrusive movement was found 17.5% higher in Group I (88.9%) as compared to Group II (71.4%). Six months post-operative height of ramus was found 10.5% higher in Group I as compared to Group II. **Conclusion** The present study concludes the superiority of SCG over CCG graft in terms of growth and function. Continued deliberation between the two grafts with larger sample size and a longer follow-up with multicentric consensus will be required to draw definitive indications of the two grafts.

KEYWORDS

Temporomandibular joint ankylosis SCGraft Costochondral graft

INTRODUCTION

Temporomandibular joint (TMJ) ankylosis is a crippling condition commonly encountered among younger population in developing countries. Major culprits leading to the condition are trauma and joint infection; however, ankylosis may also be caused by systemic infections, autoimmune disease or may be as recurrence after failed surgery. It is an extremely disabling condition which most commonly affects the growing child (Topazian, 1964), resulting in difficulty in opening the mouth, thereby causing problems in mastication and speech, potential airway obstruction, improper dental care, and a progressive facial deformity with its associated psychological and social effects. The various techniques for surgical correction of TMJ ankylosis are gap arthroplasty, interpositional arthroplasty, and joint reconstruction. A number of interpositional materials have been used including alloplastic materials (acrylic, proplast-teflon, and silastic) and autogenous tissues (temporalis muscle flaps, buccal fat pad, dermis, costochondral grafts (CCGs), metatarsal, fibula, tibia, iliac crest, cranial bone, and Sternoclavicular graft (SCG) and cartilage). Even though various alloplastic materials have been used for TMJ reconstruction, the inherent growth potential within the cartilaginous grafts makes them a first choice for TMJ reconstruction in young patients with growth potential. The costochondral grafts (CCGs) have been used for reconstruction of TMJ in ankylosis patients, but because of the unpredictable growth, warpage, and fracture of the CCGs, a need has emerged to search for an alternative. It is observed that in humans, the Sternoclavicular joint and TMJ are similar morphologically and histologically as they are the only two synovial joints covered with fibrocartilage. This similarity of the joints has encouraged the surgeons to use Sternoclavicular graft (SCG) as an alternative to CCGs.

The aim of this study is to compare outcomes of sternoclavicular graft with costochondral graft in terms of maximum mouth opening, Laterotrusive and protrusive movements and donor site morbidity.

MATERIALS AND METHOD:

The randomized prospective study was conducted on thirty patients between age 10 years -19 years who visited the, Department of Oral and Maxillofacial Surgery, SGT Dental College, Hospital and Research Institute, Budhera, Gurgaon, with temporomandibular joint ankylosis. Patients were divided into two groups after satisfying the inclusion and exclusion criteria. In Group I patients sternoclavicular graft was used as interpositional material and in group II patients costochondral graft was used. Follow up done at 1 month, 6 month, 1 year and 3 year. Preoperative assessment included a thorough history and physical examination to determine the cause of ankylosis, measurement of MIO, photographs and orthodontic evaluation of skeletal pattern, and occlusion and facial symmetry. Assessment of

clinical parameters included mouth opening, lateral excursion, and protrusive movements at regular follow-up. Radiographic analysis included panoramic, cephalogram, computed tomography (CT) scan, and a posteroanterior (PA) view of the chest. CT scanning was used to clarify the status of the TMJ and for outlining the osseous mass. The PA chest radiograph was taken to assess the thickness of the clavicle and any abnormality. Cephalometric analysis was carried out using Grummons analysis of a PA cephalogram. The difference in length between the two mandibular rami was assessed by dropping a perpendicular from the mastoid to the bigonial line on each side and measuring the distance. Lateral cephalogram were analyzed pre and post operatively to determine the length of the graft to restore the height of the ramus and to determine mandibular growth following grafting. The condylion-gonion and condylion-gnathion lengths were measured on the lateral cephalogram to assess any significant Changes subsequent to grafting.

SURGICAL TECHNIQUE

All the patients were treated under general anesthesia with tracheostomy. In all the cases, assess to TMJ was done using Al kayat Bramley incision with deep subfacial approach using CT scan as a guide to know the extent of ankylotic mass on the medial aspect. After releasing the ankylotic mass by gap arthroplasty (1.5–2 cm), intraoral coronoidectomy was performed on both the sides.

In group I : TMJ was reconstructed using SCG. SCG was harvested from the ipsilateral side using supraclavicular incision, 1–2 cm above the clavicle. In female patients, the incision was kept 1–2 cm inferiorly for cosmetic reason. As proposed by Wolford *et al.*, the incision extended from condylar head approximately 8–10 cm. Muscle attachments and periosteum were dissected from the superior and medial aspects of the clavicle. The integrity of the ligamentous attachment of the articular disc to the head of the clavicle was maintained. The superior half of the clavicle was used as a graft leaving the inferior part intact in all cases. To simulate the head of the condyle anatomically, the graft was prepared for insertion after shaping the cartilage.

It is advisable to harvest the graft after osteoarthrotomy of the ankylosed bony part has been completed. The recipient bed was prepared to receive the graft by decorticating the lateral aspect of the ramus and preparing a groove wide enough to receive the graft. Multiple holes were made throughout the harvested graft for rapid revascularization.

In group II: With the help of thoracic surgeon, the 6th or 7th rib with 1 cm of attached costal cartilage was harvested subperiosteally. Length

of the rib varid depending on the correction of the vertical height of the ramus. The periosteum was reconstituted and the wound was closed in layers. The cartilage was shaped so that the mediolateral dimension was more than the anteroposterior dimension so as to mimic the original condyle of the mandible

A negative suction drain was then placed in the donor and recipient sites for 24–36 h after obtaining hemostasis. Subsequently, the muscle layer was sutured using 3-0 vicryl, and skin closure was done using 4-0 prolene at the donor site. On the other hand, the Alkayat and Bramley fascial closure was done using 3-0 vicryl and skin closure was done with 4-0 prolene. Pressure dressing was placed on both the sides for the next 48 h. Postoperatively, all patients were placed in intermaxillary fixation (IMF) for 1 week for stabilization of the graft, and physiotherapy was commenced on the 7th day after IMF release using “Heister jaw opener” for 6 months to maintain and improve the intraoperative mouth opening. Regular follow-up was carried out weekly for a month, then at 3-month intervals for 1 year and yearly for the next 3 years. The clinical parameters including MIO pre- and post-operatively, protrusive movements, Laterotrusive movements, and donor-site morbidity were evaluated.

Post-Operative Assessment

The complications of graft harvest site in both the groups were assessed.

Post-operative radiographs were taken to assess the functional adaptation of the graft at ramus of reconstruction site and gap created between the glenoid fossa and superior part (condylar head) of the graft. Aggressive mouth opening physiotherapy was started after the third post-operative day and continued till the patients learnt the exercise and continued it by themselves. Patients were checked on regular follow-ups for at least for 6 months.

RESULT

In this study, total ten patients with ankylosed temporo-mandibular joint were recruited and randomized equally into two groups and treated with either sternoclavicular graft (Group I) or costochondral graft (Group II). The outcome measures of the study were maximum mouth opening, lateral excursion affected side and non-affected side, protrusive movement, and height of ramus. The outcome measures were assessed at pre-op and post-treatment (1 week, 1, 3, and 6 months), while the height of ramus was assessed at pre-op and 6 month post-treatment. The objective of the study was to compare the outcome measures between the two groups over the time (

DISCUSSION

Temporomandibular joint is a ginglymoarthrodial joint. This has the capability of translational as well as rotational movements.

Salins described the ankylotic mass as being an abnormal bone that replaces the TMJ and results in restriction of mandibular movement [5].

The impairment of oro-facial function may include restricted mouth opening, limited chewing ability, impairment of speech, compromised oral hygiene, restricted airway problem, and psychological stress disrupting family life [6–8].

The treatment of TMJ ankylosis is surgical, either gap arthroplasty, interpositional arthroplasty, and/or joint reconstruction using autogenous grafts or alloplastic material [9–11].

In the present study, out of ten subjects five (50.00%) were male and five were female (50.0%). Male to female ratio was 1:1.

Age of patients of Group I ranged from 8 to 17 years, with median age of 12 years, while that of Group II ranged from 7 to 15 years with median age of 13 years. Mean age of Group I (13.00 ± 3.61 years) was found to be higher than that of Group II (12.40 ± 1.47) in accordance with study of Guven and Keskin [12].

Left joint was more affected than the right joint, though our sample size did not derive any significant result, but it could be due to reflex mechanisms as majority of the population is right handed. Whenever we fall, our body tries to land on our right side, thereby having contrecoup injury to TMJ, which is well supported by Kavin et al. [13].

At all subsequent follow-ups, there was increase in mouth opening in

both the groups, although statistically insignificant increase in mouth opening was always greater in Group I as compared to Group II also be attributed to the release of ankylotic mass and, thereby, free translatory movement of mandible on the affected side. At the final evaluation (i.e. mean change from pre-op to 6 month), the increase in lateral excursion at affected side was found to be 1.3% higher in Group I (84.6%) as compared to Group II (83.3%) (Fig. 8). This finding can be attributed to the fact that the muscles are in a developing state and can respond well to any favourable change in RCU to a better level. Therefore, from the result of this study, it can be assumed that reconstruction of the RCU

At the final evaluation (i.e. mean change from pre-op to 6 month), the increase in lateral excursion towards the non-affected side was found to be 10.3% higher in Group I (76.9%) as compared to Group II (66.7%) (Fig. 9). This can be due to anatomic resemblance of SCG to the mandibular condyle and probably lateral pterygoid function being regained on the reconstructed RCU.

However, Wolford et al. [14] stated that even with the reconstruction of RCU by total joint replacement, patients can expect a decrease in pain and increase in incisal opening but no significant improvement in lateral excursive movements. The reason for this difference could be the use of autogenous graft for reconstruction, which favours reattachment of lateral pterygoid to improve lateral excursion.

Singh et al. [7] reported that when RCU reconstruction performed using interpositional arthroplasty with SCG, laterotrusive movement was 4.1 ± 1.98 mm towards the affected side and 2.4 ± 0.99 mm towards the normal side.

In our study difference in pre-operative heights of ramus in Group I and Group II was 45.00 ± 1.76 mm and 43.20 ± 1.32 mm respectively. At the 6 month, heights of ramus in

Group II (38.00 ± 1.14 mm) were found to be lesser than those of Group I (41.00 ± 1.10 mm).

Elgazzar et al. reported that marked improvement in mouth opening was documented when the ramus-joint complex was reconstructed using distraction osteogenesis (34.7 mm), costochondral graft (34.4 mm) and Surgibone (34.6 mm). Gap arthroplasty showed least satisfactory mouth opening compared with other techniques.

At the final evaluation (i.e. mean change from pre-op to 6 month), the increase in protrusive movement was found to be 17.5% higher in Group I (88.9%) as compared to Group II (71.4%) This can be attributed to the fact that CCG has less growth potential as compared to SCG, since the height of the of the ramus achieved was more in CCG group as compared to the SCG group.

On comparing the mean height of ramus of mandible between both the groups, statistically no significant difference was found. However, the height of ramus was found to be 10.5% higher in Group I as compared to Group II which may be due to bone-cartilage junction which provides a centre with growth potential.

In this study, none of the cases in either group showed infection, nerve damage, or recurrence post-operatively till 6 months. In the present study, all the cases using the SCG and CCG showed complete regeneration of the clavicle and rib, respectively, during the follow-up.

Clinical Implication

In the treatment of TMJ ankylosis, this study favours reconstruction of the RCU for better joint function. Although the procedure is time taking and prone to complications most of which are self-resolving, the results attained with reconstruction of the RCU are more satisfactory and beneficial for the patient.

CONCLUSION

The assessments of effectiveness of two surgical techniques in interpositional arthroplasty for treating TMJ ankylosis were made on the basis of ease of surgical techniques and post-operative observations. There is an increase in protrusive movement and post-operative mouth opening in patients who underwent interpositional arthroplasty and reconstruction with SCG, while in CCG group lateral excursive movement was greater and adaptive changes could be assessed easily in terms of functional and radiographic outcomes.

Increase in height of ramus at 6 month was higher in patients who underwent interpositional arthroplasty and reconstruction with SSG. Thus, SCG is better for younger patients as they require more growth; additionally patients with larger deficiencies in the mandible on the affected side should be candidates for SSG, owing to its higher growth potential.

SCG is an excellent graft where compensation for existing deficiency is not much required. The study also demonstrates increased value of lateral excursion towards non-affected side when using SCG. Although this study suggests superiority of CCG over SCG in terms of growth but lack in adaptability and range of functional movement as compared to SCG, continued deliberation between the two grafts with larger sample size and a longer follow-up with multicentric consensus will be required to draw definitive indications of the two grafts.

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